Contents

Chapter 1

CROP PRODUCTION & MANAGEMENT

INTRODUCTION

Food, required for all organisms including human beings, is an edible or potable substance (usually of animal or plant origin). It consists of nourishing and nutritive components such as carbohydrates, fats, proteins, essential mineral and vitamins, which (when ingested and assimilated through digestion) sustains life, generates energy, and provides growth, maintenance, and health of the body. The green plants synthesize their food by the process of photosynthesis while man and other animals directly or indirectly depend on plants for their food requirement.

Humans obtain their food from plants as well as animals. They grow plants and rear animals to meet their daily requirements.

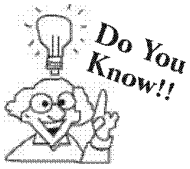
But since, human population is increasing day by day, also their food requirement is increasing along with it. Hence, we need more than a quarter of billions of tonnes of grain every year to meet this increasing demand of food. But have you ever thought *how is the food requirement to a large number of people in a country fulfilled?* The food requirement is achieved by farming more lands, increasing the food production and by managing the production and distribution of food.

CROP

Crop is a plant or plant product that can be grown or cultivated and harvested extensively for profit or subsistence. For example, if all the plants of maize are grown in a field, then it is called a maize crop. Similarly, if all the plants of wheat are grown, then it is called a wheat crop.

Crop can be used as:

- *food crops*, for human consumption (e.g., wheat, potatoes).
- *feed crops*, for livestock consumption (e.g., oats, alfalfa).
- *fibre crops*, for ropes and textiles (e.g., cotton, hemp).
- *oil crops*, for consumption or industrial uses (e.g., cottonseed, corn).
- *ornamental crops*, for landscape gardening (e.g., dogwood, azalea); and industrial uses.
- *secondary crops*, for various personal and industrial uses (e.g., rubber, tobacco).



*The **first cultivated** crop plants were cereals such as wheat, barley, rice and maize. Their seeds are rich in carbohydrates and therefore form the staple diet almost everywhere in the world. Wheat is the most important cereal in the world, followed by paddy and maize.*

Table : Some other examples of crops

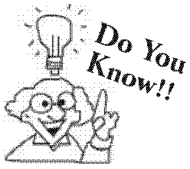
Crops	Examples
Cereal crops	Wheat, Paddy, Millet, etc
Pulses	Gram, Peas, Beans
Oil seeds	Mustard, Groundnut, Sunflower
Vegetables	Tomato, Cabbage, Spinach
Fruits	Banana, Mango, Orange etc.

All the crops are grown in their respective seasons. Paddy, for example, is grown during rainy season while maize is grown during winter season. Therefore, **on the basis of seasons, all the crops are categorised into two main groups** —kharif crops and rabi crops.

(i) Kharif crops : The crops grown in rainy season during the months of June to October are called Kharif crops. They are also known as summer or monsoon crop. These crops require warm, wet weather at major period of crop growth and also required short day length for flowering. Soyabean, maize, sugarcane, groundnut, paddy and cotton are the examples of Kharif crops.

(ii) Rabi crops : The crops grown in winter season from November to April are called rabi crops. They are also known as winter crop. Crops grow well in cold and dry weather and require longer day length for flowering. Wheat, barley, mustard, peas etc. are some examples of rabi crops.

Another type of crop is **summer/zaid crops**. These crops are grown in summer month from March to June. They require warm day weather for major growth period and longer day length for flowering. E.g. groundnuts, watermelon, pumpkins, gourds.



Worms helps plants by mixing the soil, so gardeners love them because they are "free" help.

CHECK Point

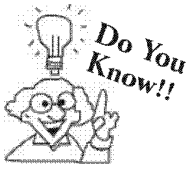
1. **Why we classify crop plants?**
2. **What will happen if the farmer grows Rabi crops during rainy season instead of winter?**
3. **Why crops such as paddy are grown only in rainy season?**

SOLUTION

1. We classify crop plants:
   - To get acquainted with crops.
   - To know the adaptability of crops.
   - To know the growing habit of crops.
   - To know the growing season of the crop

- To understand the climatic requirement of different crops.
- To know the economic produce of the crop plant & its use.
- To understand the requirement of soil & water for different crops.
- Overall to know the actual condition required for the cultivation of plant.

2. If Rabi crops are sown in rainy season *i.e.* from June to October, then the whole plant crop will get destroyed. This could be because of factors required to maintain the crops such as lack of optimum temperature, adaptability, availability of pests and many more. Hence, Rabi crops such as wheat, mustard etc. should be sown only in winter season
3. It is because crops such as paddy require large quantity of water. Therefore, they are grown in the rainy season to fulfill their excessive water requirement.



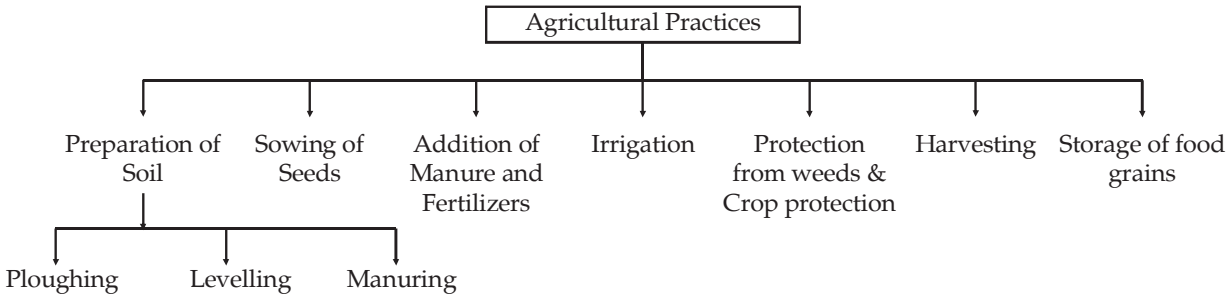
Agriculture forms a complex web of product, producer, distributor and consumer. All of them are interconnected and dependent upon each other for survival.

AGRICULTURAL PRACTICES

The growing of crops in the fields by the farmer for obtaining food like wheat, rice etc, is called *agriculture*. About 70% of the India's population is dependent on agriculture. They are also ranked second in terms of agricultural output.

Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The study of agriculture is known as **agricultural science**.

The reason for the increased agricultural output is the steady improvement in irrigation methods, new agricultural technology and modern agricultural practices. Farmers carry out certain activities in a particular sequence till the crops mature at harvest. These activities are known as *agricultural practices*. These practices increases the overall yield of a crop.



Outline classification of basic agricultural practices carried out at various stages of crop production

PREPARATION OF SOIL

Crop quality greatly depends on soil composition. The ideal soil is balanced, well-drained, fertile and with a pH (acidity level) situated between 6 and 7. It is important to add decomposed manure or compost which, in addition to improving soil structure and composition, will supply nutritive elements required by the plants. Preparation of soil is the first step to be followed before growing a crop. It is usually employed to loosen the soil. Plants absorb water, nutrients and salts from the soil. Therefore, it is important to prepare soil for a healthy produce.

METHODS OF SOIL PREPARATION

The soil is prepared for sowing the seeds of the crop by ploughing, levelling and manuring.

Ploughing

The process of loosening and turning the soil is called ploughing or tilling. A properly set up plough will break and turn the soil so that all the weeds, (grass), crop residue and debris are buried without any scrap of waste present in the field. It also provides a seed free medium for planting an alternative crop.

The loosening of soil plays an important role in crop production because –

(i) It allows the plant roots to penetrate freely and deeper into the soil so that plants are held firmly to the ground.
(ii) It also allows the roots of the plant to breathe easily. It is because loose soil can hold a lot of air in its spaces.

(iii) It helps in the growth of microbes and worms present in soil.
(iv) It helps to remove weeds and other undesirable plants in the field.

Knowledge ENHANCER

FRIENDLY EARTHWORMS

Earthworms are called best friends of farmers. They can consume practically all kinds of organic matter. They pull down any organic matter that is deposited on the soil surface such as leaf fall, debris etc. This organic matter then undergoes biochemical change in the intestine of earthworm. Hence, earthworm converts the dead organic matter into rich humus, thereby enriching the soil with nutrients.

Earthworms are important to farmers in the following respects :-

(i) It improves the soil fertility.
(ii) It maintains the physical condition of the soil.
(iii) It helps in mixing of sub soil and top soil.
(iv) It helps in providing required nutrients to plants.
(v) It helps in recycling of waste materials in the surroundings.

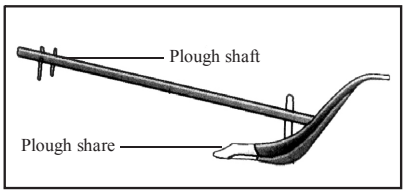
Tools used for ploughing are : plough, hoe and cultivator.

(i) Plough : It is the most ancient method for ploughing the seed. Ploughs are traditionally drawn by working animals such as horses or cattle, but in modern times may be drawn by tractors. A plough may be made of wood, iron, or steel. It contains a triangular iron rod which is called ploughshare. Then there is a long log of wood called ploughshaft.

The one end of the shaft has a handle and the other end is attached to a beam which is placed on a pair of bulls or other animals such as camel, horse etc.

Importance of plough

(i) It is used for breaking large lumps of soil into small pieces.
(ii) It is used for disposing weeds, grass, crop residues, debris etc from soil.
(iii) It is used for adding manure or fertilizers to the soil.

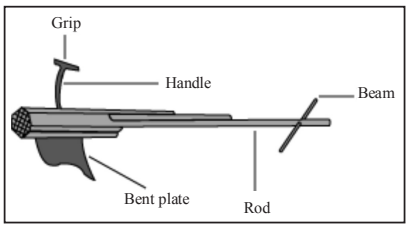


Plough

(ii) Hoe : Hoe are bladed tools that have a long rod of woods or iron. The one end of wood has a fixed strong blade and a bent plate of iron that works like a blade. The other end is attached to a beam that is placed on a pair of bull during ploughing the field.

Importance of hoe

(i) To agitate surface of soil so as to remove weeds and other unwanted plants.
(ii) To dig and move the soil upside down.
(iii) To chop roots and other crop residues.



Hoe

(iii) Cultivator : It is the modern method of ploughing done these days. It is an implement equipped with shovels, blades etc. and used to break up soil & remove seeds. Cultivators are very similar to harrows in their function but are generally used to work large clods of soil while harrows tend to be used afterwards to create finer tilth. While the terms cultivator and harrow are sometimes used interchangeably, cultivators are determined by their ability to penetrate large depths in order to sufficiently break up the soil for seedbed preparation. It involves the use of tractor to drive cultivator.

The tractor type cultivator tiller is suitable for large scale farming especially when you want to plant grain crops like wheat, corn and others. If you have a few acres of land to cultivate, you should invest in this type of cultivator tiller. With the help of a tractor, you can till and cultivate large acres of land in a short period of time.

Importance of cultivator

(i) It removes and destroys weeds, as well as fertilizes the soil and covers seeds with soil.
(ii) It saves labour time involved during ploughing.

Cultivator driver by truck

Levelling

Unevenness of the soil surface has a significant impact on the germination & yield of crops. After ploughing, the field is levelled with the help of a leveller. It is because the ploughed soil is quite loose, so it is liable to be carried away by strong winds or washed away by rain water. The ploughed soil is levelled by pressing it with wooden leveller.

Importance of levelling

(i) It prevents the top fertile soil from being carried away by strong winds or washed away by rain water.
(ii) It helps in uniform distribution of water in fields during irrigation.
(iii) It prevents the loss of moisture from ploughed soil.
(iv) For better crop establishment.
(v) It reduces irrigation time.
(vi) Less effort in crop management.
(vii) It increases the yield and quality.
(viii) Optimization of water use efficiency.


Levelling of agricultural land

Manuring

Manuring

Manure is organic matter used as fertilizer in agriculture. Sometimes before ploughing, the manure is added to the soil. The process of applying organic minerals and adding nutrients to the soil is called **manuring**. This is done for proper mixing of manure with soil. Manuring is done to increase the fertility of the soil before seed is sown in field. Manures improve the fertility of the soil by adding organic matter and nutrients, such as nitrogen that is trapped by bacteria in the soil. Higher organisms then feed on the fungi and bacteria in a chain of life.

SOWING OF SEEDS

Sowing of seeds is the second important step of crop production. Once the soil in the fields has been prepared by ploughing, levelling and manuring, the seeds of the crop can be sown in it. S*owing is the process of placing the seeds in the ground soil for future growth of crop plants*.

However seeds those are to be selected for growing should be of good quality. The quality of seed depends on the plants that are used for collecting seeds.

CHARACTERISTIC OF PLANTS THAT ARE USED FOR COLLECTING THE SEEDS

(i) Plants should be healthy and of vigorous growth.
(ii) Plants resistant to pests and diseases. So that they will produce healthy seeds.
(iii) Seeds should be collected from matured, well formed plants that produce sweet tasting fruit.
(iv) Always collect healthy seeds from high yielding plants. This will ensure the good yield of plants in subsequent generation.

METHODS OF SOWING SEEDS

There are two methods of sowing the seeds in the soil. These are sowing by hand and by seed drill.

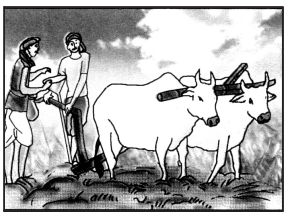
Sowing by Hand

The scattering of seed by hand is the simplest and ancient method of delivering seed to the soil. This process is known as *broadcasting*. In this method, the seeds are scattered in the field by the farmer in standing position. This method, however has few disadvantages like the seeds may not be properly distributed in field and may fall in clusters at one place and at another place there may be none.

Sowing by a Seed Drill

Sowing of seeds by drill is a better method of sowing than broadcasting. The seeds sown with this method are sown at right intervals and at a proper depth.

TOOLS USED FOR SOWING SEEDS



Traditional method of sowing

Traditional Tool

It is a funnel shaped tool and is driven by plough. The seeds are filled into the funnel that has a long pipe with sharp ends. The seeds from the funnel moves into the pipe placed into the soil as plough move.

Modern Method (Seed drill)

Seed drill is a machine for planting seed at a controlled depth and in specified amounts. These days seed drills are used (for sowing seed) that involves the use of tractors.

A seed drill is a long iron tube having a funnel at the top. It is tied to back of the plough and seeds are put into the funnel of the seed drill. As the plough makes furrows in the soil, the seeds from the seed drill are gradually released and sown into the soil furrow made by plough.

Modern method of sowing (Seed drill)

Importance of seed drill tool

(i) It allows uniform distribution of seeds into the soil at a proper depth.
(ii) It also protects the seeds from birds.
(iii) It also saves times.

PRECAUTIONS TO BE TAKEN WHILE SOWING SEEDS IN SOIL

(i) **The seeds should be sown at right intervals or spacing**. It is because sowing seeds at proper distance avoids the competition among the plants. All plants in the field require optimum light, water and nutrients for their normal growth and development. So if they are grown nearby they might compete with each other and in turn would reduce the yield of crop. Therefore, it is advised to sow seeds at uniform distances.

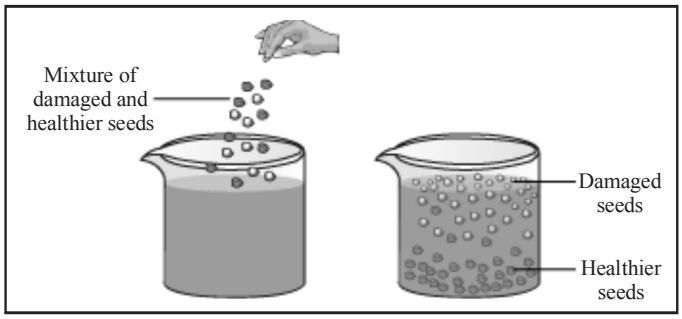
(ii) **Seeds should be sown at right depth in soil**. If the seeds are sown too deep, then they may not germinate because they cannot breathe due to insufficient air at greater depth. Also, if you just spread the seeds on the surface of the soil, then the seeds will be easily picked and can be eaten by birds. *Hence*, seeds should be sown at proper depth in soil.

(iii) The seeds used for sowing should be clean, healthy and free from diseases.

IN THE LAB

How can you find whether the given sample of seeds are healthier or not?

Take a clean jar half filled with water. Put some seeds (damaged and healthy) into the jar and stir it well.
Now observe the seeds present in jar.



What do you observe?

You can see some of the seeds are floating on the surface while some of them settle at the bottom.
The seeds that float on water are actually damaged seeds. They are hollow from inside. *Hence*, they are lighter in weight and float at the top. Whereas healthier seeds sink to the bottom of jar. Healthy seeds are heavier and healthy in all respects.

CHECK Point

Why seeds are not sown in dry and highly wet soil?

SOLUTION

Moisture in the soil is necessary for germination. So, if seeds are sown in dry soil, they may not germinate. Similarly, if the seeds are sown in a highly wet soil, then on drying, the soil surface becomes too hard that the germinating seedling might not come out of ground.

CONNECTING TOPIC

TRANSPLANTATION

Sometimes some seeds (for example, rice, tomato, chilli, cabbage, bringal etc) are not directly planted in the fields, instead they are planted in the seed beds called nurseries and when they grow into seedlings they are transferred in the field.

You must have seen farmers transplanting paddy (rice) seedlings in the fields. This method is known as **transplantation**.

In case of paddy (rice) crops, the seeds are first sown in a small plot of land and then allowed to grow into tiny plants called seedlings. After the seeds have grown into tiny plants (called seedling) in the nursery, only the healthy and well-developed seedlings are then picked out and transferred to the regular field for further growth.

Paddy Seedling transplantation

This process of transferring the seedlings from the nursery to the main field by hand is called transplantation. During transplantation, farmers keep the proper distance between various seedlings and also between rows of seedling. This is done to ensure that each and every plant gets the sufficient sunlight, water and other nutrients for normal and healthy growth of plants. This process of transplantation has several advantages over the direct sowing.

Advantages of Transplantation

(i) It enables us to select only the better and healthy seedlings for the cultivation of crops.
(ii) It allows better and deeper penetration of roots in the soil.
(iii) It promotes better development of shoot system of plants.
(iv) It allows seedlings to be transplanted at the right spacings so that each and every plantlet gets uniform dose of sunlight, water and nutrients.

CHECK Point

Find out more examples of crops that are cultivated by transplantation method ?

SOLUTION

Tomatoes and chillies

ADDITION OF MANURE AND FERTILIZERS

The plants require number of essential nutrients for their growth and development. All the nutrients required by plants can be obtained from air, water and soil. Deficiency of any of these nutrients might affect the life activities of plant, which in turn can reduce the net yield of the crop.

You must have seen that in an area, some of the plants show weak growth while some of them show vigorous growth. Can you guess, why such variations are seen?

It is because of the lack of certain nutrients required by plant for normal growth and development. Lack of nutrients makes the soil infertile. So, unless the depleted plant nutrients are put back into the soil from time to time the growth of crops would be poor. Hence, deficiency of plant nutrients in the soil is compensated by adding **manures** and **fertilizers** to the soil.

Manure

Manure is a natural fertilizer. It is prepared by the decomposition of plant and animal waste. It is known to have a large quantity of organic materials and little amount of plant nutrients. Thus, manures provide a lot of organic matter like humus to the soil. The humus improves the physical and chemical properties of the soil. It also improves the soil texture for better retention of water and aeration of soil.

Since manure is produced by decomposition of animal's excreta and plant waste, it protects the environment from harmful chemicals. Thus, it helps in recycling of farm wastes.

Farmers add manure directly to the soil in the fields or first convert it into compost by burying it in pits.

NOTE

Types of Manure

There are three types of manure: animal manure (farm yard manure), compost and plant manure.

Animal manure: This is the combination of animal faeces or dungs, urine and plant products used as beddings for the animals. Dung, farm refuse, fallen leaves, twigs etc are dumped in heaps to undergo decomposition and form dark amorphous manure. The faeces of

poultry, goat, sheep, cattle, pigs and rabbits are essential for farmyard preparation. The period of decomposition varies with the type of animal dung used. Before applying the manure, it must be allowed to decompose fully so as to avoid burning the roots of the crops.

Plant (Green) manure: Green manure refers to crops which have already been uprooted (and have often already been stuffed under the soil). Typically, plant manures are crops that are grown for the purpose of plowing them in and using it as nutrients and organic matter.

Green manure crops are commonly associated with organic farming, and are considered essential for annual cropping systems that wish to be sustainable.

Compost manure: Compost is rotten vegetable matter, garbage, sewage, sludge and animal refuse often enriched with small amounts of chemical fertilizers during decomposition stage.

Knowledge ENHANCER

WHAT IS COMPOSTING?

Composting is the process of converting dead organic matter into rich humus. The waste materials such as cow dung, vegetable waste, sewage waste etc are dumped into a pit. The pit is then covered with mud to prevent air and light entering it. It is then left undisturbed for few months. During this process, the microbes decompose the animal and plant waste and convert it into inorganic materials. These inorganic materials are excellent nutrients for plants.

Sometimes, the process of composting is done with the help of earthworm. Then this process is known as vermi-composting. Earthworms can consume practically all kinds of organic matter. This organic matter undergoes biochemical change in the intestine of earthworm. Hence, earthworm converts organic matter into rich humus, thereby enriching the soil with nutrients. The process of composting ensures the continuance of fertility cycle. Composting is considered as the best recycler in nature.

Advantages of Manure

(i) It enriches the soil with organic material.
(ii) It increases the water holding capacity of soil.
(iii) It aerates the soil by making it porous.
(iv) It helps in the growth of micro-organisms.
(v) It improves the soil texture.
(vi) It increases the crop production.
(vii) It replenishes the soil with all manures.

FERTILIZERS

Fertile soil contains minerals, organic matter and a number of microscopic forms of plant and animal life. The soil should also contain soluble minerals. If the soil is deficient in these minerals, fertilizers must be added to ensure healthy crops.

Fertilizers are commercially available plant nutrients. They can be organic or inorganic in nature. They ensure healthy growth and development of plants by providing required nutrients such as nitrogen(N), phosphorous(P), potassium(K), sulphur(S) etc to the plant. They have nutrients in a concentrated form. So they provide quick replenishment of plant nutrients in the soil and restore its fertility. Also, they have high solubility in water. So, they are easily absorbed by the plants.

Fertilizers are good only for short term use. Also it is harmful to the symbiotic microorganism that live in soil. The excess use of fertilizers also causes water pollution.

Excessive use of fertilizers degrades the quality of soil in the long run, for example, excessive use of nitrogenous fertilizers makes the soil and water rich in nitrates. Nitrogen-rich water is not good for drinking. Nitrates from the soil also flow into rivers and lakes with rainwater and enhance the growth of weeds and algae. This decreases the oxygen content of water leading to death of aquatic life. Excessive use of fertilizers can change the nature of the soil making it either too acidic or too alkaline.

NOTE

Types of Fertilizers

Nitrogenous fertilizers : Urea, Ammonium sulphate, Ammonium nitrate, Sodium nitrate.
Phosphatic fertilizers : Calcium hydrogen phosphate or superphosphate, Ammonium hydrogen phosphate, Ammonium phosphate.
Potassium fertilizers: Potassium nitrate, Potassium chloride, Potassium sulphate.

CHECK Point

How NPK helps plants in their growth?

SOLUTION

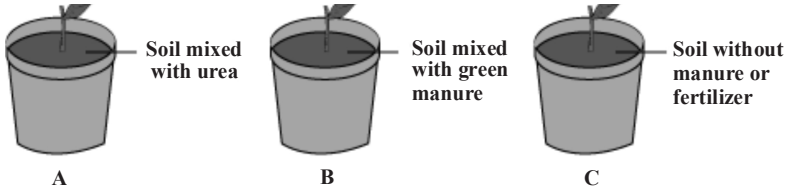
Nitrogen is extremely important for leaf growth; phosphorus promotes development of roots, flowers and seeds or fruit; and potassium is necessary for the growth of strong stems and movement of water in plants, in addition to promoting flowering and fruiting.

IN THE LAB

Let us perform an activity to find out how fertilizers and manure affects the plant growth.

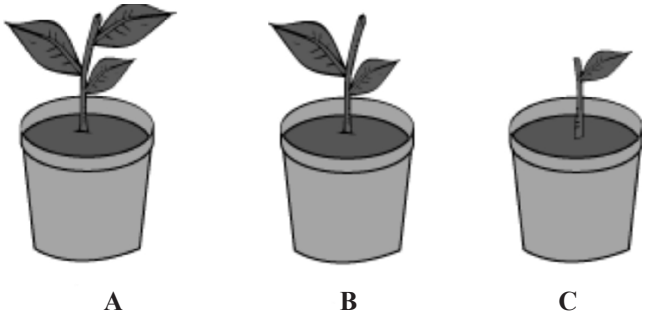
Take some healthy gram seeds and allow them to germinate in a pot.

Then take three empty jars and label them as A, B and C.
In jar *A*, add little amount of soil mixed with urea, a fertilizer.
In jar B, add similar amount of soil but mixed green manure.
In jar C, add similar amount of soil without any manure or fertilizer.
Now water all these vessels bearing soil.



Now from the pot, select three equal sized seedlings and plant them in jar A, B and C. Keep the vessel in a safe and lighted place. Water them regularly and observe the growth.

What did you observe after few weeks?



You can observe that seedlings develop into small plantlets in all the three jars after few days. However, their growth varies in all the three.
The jar A shows maximum growth while jar C showed the least growth.
Plantlets in jar A showed the maximum growth because urea is readily soluble in water and is quick acting. When it is supplied to the soil, nitrogen is rapidly changed into ammonia. Later seeds use this ammonia for its growth and development.
The plantlets in jar A also show the growth but less compared to jar B.
The growth of plantlet in jar C is least because soil is infertile as it lacks certain essential soil nutrients.

Table : Differences between manure and fertilizers

	MANURE	FERTILIZERS
i.	Manure is a natural substance that is prepared by decomposition of animal excreta and plant wastes.	They are commercially available plant nutrients.
ii.	They have large quantity of organic material and little amount of plant nutrients.	They can be organic or inorganic in nature.
iii.	They help in enriching the soil with organic matter and nutrients.	They help in enriching the soil with organic matter and nutrients in concentrated form.
iv.	It provides humus to the soil.	It does not provide any humus to soil.
v.	It protects the environment and helps in recycling of waste	Its excessive use can cause pollution.
vi.	It is slowly absorbed by the plants.	It is readily absorbed by the plants.
vii.	Example– animal excreta, plant waste, sewage waste etc.	Example– sodium nitrates, urea, ammoniam sulphate etc.

CONNECTING TOPIC

CROP ROTATION

Crop rotation is the practice of growing two or more varieties of crops on the same land in sequential seasons.

The continuous growing of same crop over and over again might reduce the particular nutrient from the soil. Hence, farmers employ crop rotation so that they can replenish the lost nutrients from the soil.

In crop rotation, the cereal crops like wheat, maize etc are grown alternately with leguminous crops like pulses, beans, peas, etc. Legumes have nitrogen fixing bacteria in their root nodules that can fix atmospheric nitrogen.

For example, when maize crop is grown first, it takes away a lot of nitrogen from soil for its growth and development and makes the soil nitrogen deficient. And next, when leguminous crops are grown in the same field, leguminous crops with its nitrogen fixing bacteria enriches the soil with nitrogen compounds and increases its fertility. When another cereal crop like wheat is grown after that, then wheat can utilize this extra nitrogen from soil for its growth and produce a crop with increased yield. In this way, rotating different crops (leguminous and non-leguminous crops) in the same field replenishes the soil with nitrogen naturally and thereby increases the crop production.

Advantages of Crop Rotation

(i) It improves the fertility of soil and hence brings about an increase in food production.
(ii) It reduces the need of fertilizers.
(iii) It reduces the build up of pests & diseases that affect different group of plants.
(iv) They ensure that enough nutrient are available to different crops each year.
(v) It aids in building and maintaining healthy soil by maintaining level of its organic matter and soil structure.
(vi) It controls weeds.

NOTE

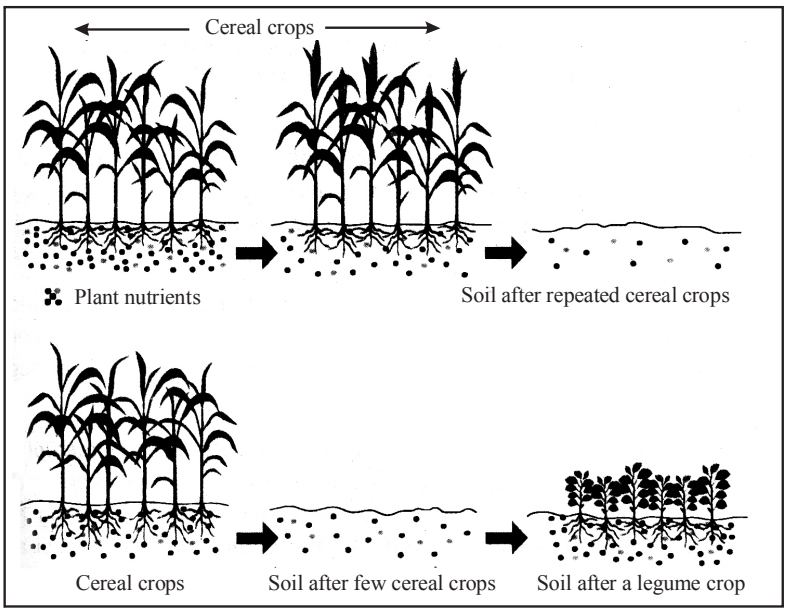
Monoculture is the repeated planting of the same crop in the field year after year.

Intercropping is the growth of two or more crops in proximity in the same field during a growing season to promote interaction between them. Available growth resources, such as light, water and nutrients are more completely absorbed and converted to crop biomass by the intercrop as a result of differences in competitive ability for growth factors between intercrop components. The more efficient utilization of growth resources leads to yield advantages and increased stability compared to sole cropping.

Mixed cropping, also known as multiple cropping, is growing of two or more crops simultaneously on the same piece of land. It leads to an improvement in the fertility of the soil and increase in crop yield. The products and refuse from one crop plant help in the growth of the other crop plant and vice-versa. Mixed cropping is an insurance against crop failure in abnormal weather conditions. It also helps the farmer to improve its yield and economy and avoid crop failure which was very common in India and Asian countries.

CHECK Point

Study the given sequence of pictures and then answer the questions.



1. **What happens to plant nutrients in soil after growing cereals repeatedly in same field for many years?**
2. **Does soil fertility decrease when only cereal crops are grown again and again?**
3. **What happens to plant nutrients in soil after growing leguminous crops?**

SOLUTION

1. The continuous plantation of crops in a field makes the soil poor in certain nutrients such as nitrogen, phosphorus, potassium etc. As a result, the soil fertility decreases and hence the crop yield.
2. The soil fertility decreases when crop with similar requirements are grown again and again. *For example*, when a crop like maize is grown, it takes away a lot of nitrogen from soil for its growth and makes the soil nitrogen deficient. If now, the same kind of crop or crop with similar requirement is grown then it would further make the soil nutrient deficient. Thus, the continuous plantation of any crop in field makes the soil poor in certain nutrients.
3. Legumes have nitrogen fixing bacteria in their root nodules that can fix atmospheric nitrogen. When the leguminous crop is grown in the same field, then the leguminous crop with its nitrogen fixing bacteria enriches the soil with nitrogen compounds and increases its fertility.

IRRIGATION

Water is essential for the growth of plants. It transports all nutrients required by the plant to each and every part of the plant body. It also maintains the moisture of soil and prevents soil from drying.

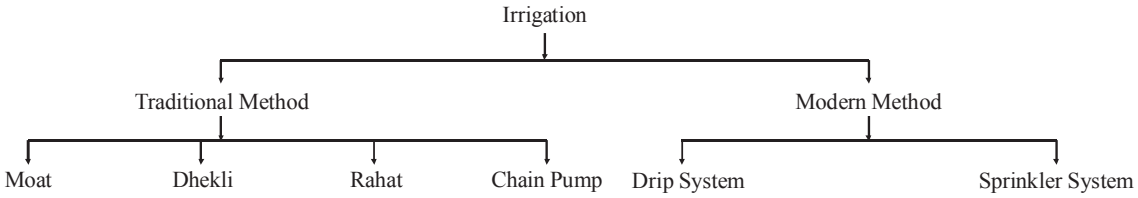
It is therefore, necessary to supply water to crop plants in the fields, periodically. *The process of supplying water to crops in the fields is called* **irrigation**. Irrigation is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. It also protects plants against frost, suppressing weed growth in grain fields and preventing soil consolidation. The time and frequency of irrigation varies according to different seasons, crops and soil types. The various sources of irrigation are wells, canals, rivers, dams, ponds and lakes. Even rain is a source of irrigation of crops.

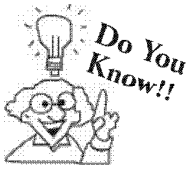
IMPORTANCE OF IRRIGATION

(i) Irrigation before ploughing makes the soil soft due to which ploughing becomes easier.
(ii) It provides moisture for germination of seeds.
(iii) It is important for the absorption of nutrient elements by plants from soil. The water dissolves the nutrient present in the soil to form a solution. This solution of nutrients is then absorbed by the roots for the development of plants.

METHODS OF IRRIGATION

Two methods of irrigation that helps in conservation of water are : **traditional method** and **modern method**.





Waterlogging

Waterlogging refers to the saturation of soil with water. It occurs whenever the soil is so wet that there is insufficient oxygen in the pore space for plant roots to be able to adequately respire. Other gases detrimental to root growth, such as carbon dioxide and ethylene, also accumulate in the root zone and affect the plants.

Most often, waterlogged conditions do not last long enough for the plant to die. Once a waterlogging event has passed, plants recommence respiring. As long as soil conditions are moist, the older roots close to the surface allow the plant to survive.

Traditional Method

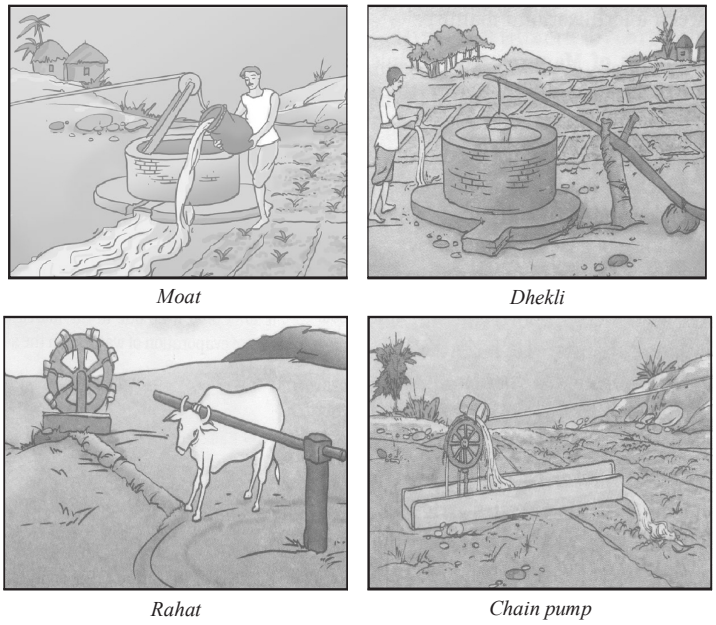
This method was used earlier for irrigation. They are cheaper but less efficient. It often includes pulley system that are used to deliver water to soil, vegetation, flowers and/or other forms of plant life. Types of traditional methods are moat, dhekli, rahat and chain pump.

(i) **Moat:** It is based on pulley system. Moat is a deep, wide ditch that is usually filled with water and that goes around the walls of a place (such as a castle) to protect it from being attacked. It has been used to collect water that was then taken directly to the fields *via* buckets and placed over the crops. In other forms wells were used to keep water contained to draw on it.

(ii) **Dhekli:** Dhekli is mainly seen in rural areas. It is done manually. The person had to take out water through a bucket and pour it into the field. This causes a lot of water wastage and now for water scarcity, people don't use this method of irrigation.

(iii) **Rahat:** It is based on lever system. The rahat system of irrigation was used in older times as a way to get water from a well by using oxen. The Rahat System of irrigation requires a large well in which a wheel is used. The wheel is turned by oxen, buffalo or cows to get the water out of the well and then spread out over the crops.

(iv) **Chain pump:** It is based on pumps. Chain pump is a type of water pump. The pump consists of a pipe connected to a water supply, a circular chain and flat platters that are the same size and shape as the pipe. These platters are connected to the chain, which is then drawn up through the pipe. Water is caught on the platter and brought up to the surface. The chain is circular, so as the platters rise on one side of the chain, they drop back into the water.



Moat *Dhekli*

Rahat *Chain pump*

Traditional methods of irrigation

Modern Methods

Modern methods of irrigation are used for supplying water to fields.Types of modern method of irrigation are : sprinkler system of irrigation and drip system of irrigation.

(i) Sprinkler system : This system of irrigation supplies water to plants (crops) in the form of rain. It consists of perpendicular pipe which has a rotating nozzle on to and it is joined to main pipeline. Water escapes from the rotating nozzles when water is passed through the main pipe. In this method, water is supplied using pipes to one or more central locations within the field. When water is allowed to flow under high pressure with the help of pump, it gets sprinkled on the crops.

This method is more useful on uneven land that have fewer water supplies. Most of the crops such as wheat, grain, vegetable, pulses etc are irrigated by this method of irrigation.

Advantages of sprinkler system of irrigation

(i) It provides efficient coverage of water from small to large areas.

(ii) It has a wide range of water capacity. Hence, they are used for nearly all soils.

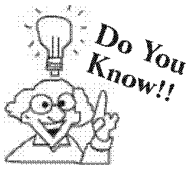
(ii) Drip system : Drip irrigation systems are methods of microirrigation wherein water is applied through emitters to the soil surface as drops or small streams. The discharge rate of the emitters is low so this irrigation method can be used on all soil types. This method of irrigation is more efficient for irrigating fruits and vegetables. In this method, water is delivered at or near the roots of the plant drop by drop. Water is passed through plastic pipes that have holes in it. These plastic pipes are then laid along the rows of crop. This is the most efficient method of irrigation as there is no wastage of water at all.

Advantages of drip system of irrigation

(i) It saves water, as water is delivered at or near the roots of the plant.

(ii) It avoids random watering of crops.

(iii) It improves water holding capacity of soil and reduces soil erosion.



Net irrigation water requirement (NIWR) is defined as the quantity of water which is necessary for crop growth. It is expressed in millimetres per year or in m^3/ha per year (1mm = $10m^3$/ha). It can be supplied through rainwater or through irrigation methods.

The water requirement of any crop depends on crop factors, soil factors, climatic factors and crop management practices.

CHECK Point

Why gardeners need to give more water to plants in summers?

SOLUTION

Gardeners give more water to plants in summers because in summers, the evaporation rate is high from soil and leaves. This makes the soil deficient of of important nutrients required for the growth of plant. Hence, we need to give more water to plants to prevent drying of plants.

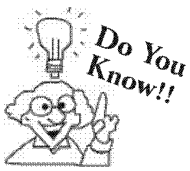
CONNECTING TOPIC

EFFECT OF EXCESSIVE IRRIGATION OF WATER

The crops need to be irrigated with just the right amount of water, neither too little nor too much. Excessive irrigation of water is harmful to crops because,

(i) Excessive supply of irrigation water to crop fields reduces the air trapped in the spaces between soil particles. As a result the roots of crop plants do not get sufficient air to breathe and hence they die.

(ii) Also, excess of water in the fields increases the amount of salt on the surface of soil, which is formed due to excessive evaporation. The accumulation of salt in the field lower the fertility of soil and hence reduces the crop growth and development.



It takes 100 pounds of rain water to produce a single pound of food from the food.

Between 10 and 20 tons of water must pass through the roots of an acre of corn before one bushel of corn will be produced.

CHECK Point

Why potted plants in our homes do not grow well if they are given excess of water?

SOLUTION

It is because, excess of water expels most of the air from the spaces between soil particles. As a result, plant roots do not get sufficient air to breathe and hence they do not grow well.

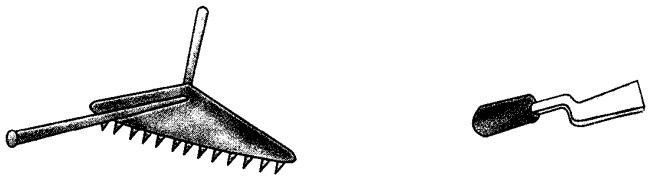
Knowledge ENHANCER

WHAT IS LODGING?

The falling of mature crop plants in the fields due to action of strong winds is called lodging. The correct timing of irrigation is very important for a good crop yield. For example, if the irrigation of a wheat field is done when the crop has fully matured or if there is heavy rainfall during harvesting season, then the wheat plants are unable to resist strong winds. In such cases, a strong wind blowing over the fields make the matured wheat plants fall on the ground. As a result, the quantity and quality of wheat crop and straw decreases. Thus, lodging decreases both the quantity and quality of crop. It also reduces yield and quality of straw. There are many external factors that have influence on lodging including: wind, rain, topography, soil type, fore crop, tillage, nitrogen fertilizers, diseases, sowing date, seed rate, and variety. Lodging has a negative influence on both the yield and the yield quality.

PROTECTION FROM WEED

When you grow a food crop in the field, you must have noticed the growth of certain other plants along with major cultivated crop. What are these? These undesirable plant that grow along with crop are called **weeds**. Weeds compete with the crop for water, nutrient, space and light. As a result of competition, crops gets lesser amount of nutrients, space and light that are required for survival. *Hence,* the productivity of crop reduces. Therefore, it is necessary to remove the weeds from the crop. Wild oat, Grass, *Amaranthus*, *Xanthium*, *Parthenium* are common weeds.



(a) Harrow *(b) Trowel (Khurpi)*

Implements used for weeding

The process of removing weeds from the cultivated field is called **weeding**. The best time to remove weeds is when the soil is damp and moist, *for example*, the day after it has rained during spring time. Damp soils are loose and make it easier to remove weeds with their roots. Otherwise, it may run the risk of cutting off the roots because they are stuck in the soil. If the soil is hard and there is no rain in the next few days, consider hosing down the area with water and let the water soak overnight before you start removing weeds.

Manual weeding

Spraying weedicide

Sickle (Used in harvesting)

VARIOUS WAYS OF WEEDING

(i) Removal of weeds by pulling them out with hand is the traditional method of weeding.
(ii) Proper ploughing before sowing seeds helps in uprooting weeds.
(iii) Removal of weeds by using a trowel (khurpi) and harrow. *You must have seen farmers sitting in the field and uprooting certain plant with Khurpi. What are they doing*? Any guesses!! Farmers are uprooting the undesirable plants that are grown along with main crops. This is a manual method of removing weeds.
(iv) Crop rotation is another method for controlling the growth of weed. The weeds are very choosy about the crops with which they grow. *Hence*, by rotating the crops that have different nutrient requirements in the same field, disturb the weed's life cycle and reduces their growth in the field.
(v) Weeds can also be destroyed by spraying special chemicals called **weedicides** on weeds. Benthiocarb, butachlor, 2, 4-D (2, 4 Dichlorophenoxy acetic acid) etc are some examples of weedicides. They are not harmful to crop but they can be harmful to farmers. Hence, these chemical should be carefully used and sprayed. Farmers are advised to cover their nose and mouth with a piece of cloth while spraying the weedicides on crops.

CHECK Point

Why should weeding be done before flowering?

SOLUTION

Weeding is done before flowering so that weeds cannot produce seeds to multiply their number and these seeds cannot mix with grains.

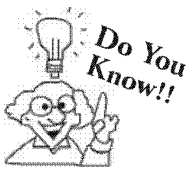
HARVESTING

The process of cutting and gathering of the matured food crop is called **harvesting**. Most of the crops are harvested in autumn season. In harvesting, the crops like wheat or rice are cut close to the ground by hand using a tool called **sickle**. It is manual method of harvesting crops. In large fields, the crops are harvested using machine called **harvester**.
In India, harvesting is done mostly by sickle. Sickle is made up of curved, plain blade of carbon steel. It has a wooden handle to hold the sickle. The tang of the blade is lightly fixed into the handle with a ferrule.
Other methods of harvesting are – forage harvesters and combines.

(i) Forage harvesters : These are tractor drawn self propelled machines that are used to collect together, chop and then discharge the crop into field as it moves through.
(ii) Combines : They are farm machines that are used to harvest seed crops and grains. Combines perform cutting, threshing, separating, cleaning and grain handling operations in the field.

Forage harvesters

Combine



The first combine harvester was designed in 1836 by America's Hiram Moore and John Hascall. It was pulled by horses.

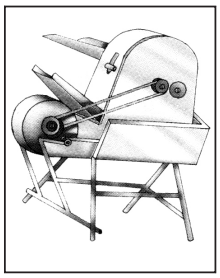
CHECK Point

Can you name some of the festivals associated with the harvest season?

SOLUTION

The harvesting of crop is considered as an important celebration for farmers. It fills the heart of all farmers with happiness and well being. Pongal, Baisakhi, Holi, Diwali, Nabomya etc are the festivals associated with the harvest season. These festivals are celebrated by farmers with great enthusiasm.

THRESHING



Thresher

After harvesting, the next step is threshing. *You must have seen farmers rubbing the grain between palm hands or beating the crops with a hard object. What are they doing?* They are separating the grain seeds from pods or chaff or plant. This process is known as **threshing**.

Threshing is the process of separating the grain seeds from the scaly, inedible chaff that surrounds it. Threshing does not remove the bran from the grain. Threshing may be done by beating the grain using a flail on a threshing floor. It is a slow and time consuming process if it occurs manually. Hence, it is carried out with a machine called "*combine*". Combine is actually the combined harvester and thresher.

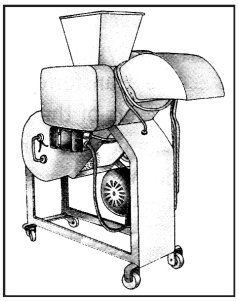
WINNOWING

After grains are threshed, the chaff is removed from the grains. This process is known as winnowing. Hence, *winnowing is the process of separating grain from the mixture of threshed chaff.*

When the grain mixed with chaff and hay is made to fall from a height in blowing wind, the grain being heavy, falls straight to the ground, whereas chaff and hay, being much lighter, are carried some distance away by the wind. In this way, the grains forms a separate heap and can be collected and packed in a gunny bag.

The machine that is used for doing winnowing is called *winnower*. It is the most efficient, quick and easy machine to separate grain from chaff.

Winnowing

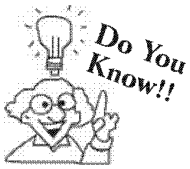


Winnower

STORAGE OF FOOD GRAINS

Storage is the most important agricultural activity. The food grains obtained by harvesting the crops are dried in the sunshine before storing. This is because higher moisture content in grain promotes the growth of fungus and moulds on the stored grain, which later damages them. *Hence*, crops are dried in the sunshine before storing to reduce the moisture content of grains and to prevent their spoilage during storage.

The farmers store the dried grains in metal bins and jute bags. The Government agencies like FCI (Food Corporation of India) buy grains from farmers and store it in big godowns. It is done so that it can be supplied throughout the country, round the year. The large scale storage of food grains is done in gunny bags and in grain silos.



Chemical Treatment : Pesticides are sprayed in the storage structure before storing food grain. This kills the pests before the arrival of stocks and also eliminates chances of contamination of food grain with pesticides. The pesticides which can be sprayed are – BHC (benzene hexachloride), malathion and pyrethrum.

(1) *Fumigation is a method by which pests are exposed to fumes or vapours of chemicals, without contaminating the stored food grains.*

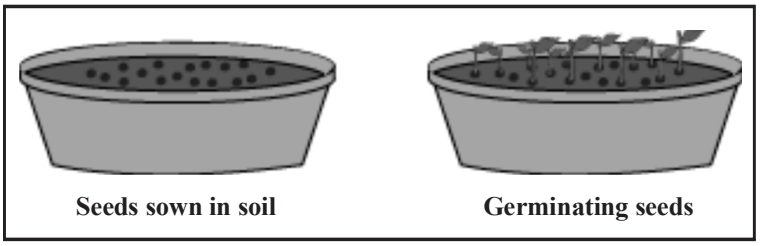
(2) *Care should be taken that the grains for human consumption are not treated with poisonous chemicals.*

IN THE LAB

How the viability of seed can be checked?

Take few stored seeds from the godowns. Count them and place then in a tray that contains fresh compost. Water the compost and keep the tray in a warm lighted place.

Observe the growth of seeds.



Seeds sown in soil | Germinating seeds

What did you observe?

You can see that more than half of the seeds sprout. It means that these stored seeds are viable and has good chances of germinating in the garden or field.

The ability of the plant to produce new plants depends on the time of harvest and the conditions of seed storage. *Hence*, it is important to take all necessary precautions while storing the seeds.

PRECAUTIONS TO BE TAKEN WHILE STORING SEEDS

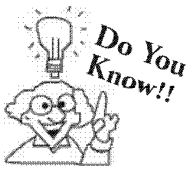
(i) Well-dried seeds should be stored. The viability of seeds depend on temperature and moisture. *Hence*, seeds should be stored at proper temperature and with proper moisture, otherwise it will deteriorate quickly.

(ii) At homes or shops the seeds should be stored in a sealed, water resistant, air tight container, then container are kept in a cool and dark place.

(iii) Protect the seed from the insects. The seeds can be protected from insects/pests by —
   (a) storing the seed with wood ash. Wood ash prevents the entry of insect inside container.
   (b) store seeds with lime. Lime has an insect repelling property.
   (c) mix the seeds with vegetable or coconut oil.

(iv) The seeds that are in bulk quantity should be stored in **silos** and **granaries**. Silos and granaries are store house for storing threshed grain that is present in large quantity. Silos are tall cylindrical containers for bulk storage of grains. Granaries are often built above the ground. The distance of granaries from the ground protects the grains from mice and other pest.

(v) Sometimes, the dried neem leaves are added along with grain to protect it from insects or pests. The leaves and oil of the neem are very effective against a wide range of storage pests.



*One of the most controversial scientific discoveries of the 20th century is the **genetic modification (GM) of food**. The genes of every living organism can be altered to change its characteristics. For example, farmers can add anti-pest genes to crops, which enable them to survive longer or grow unusually large.*

CONNECTING TOPIC

CROP IMPROVEMENT

The improvement in crop plants is necessary for increasing the crop yield and their quality.

Crop improvement can be done by breeding new varieties of crops having higher yields and resistance to pests and diseases. The agricultural scientists or plant breeders can achieve this by artificial cross-breeding or hybridization.

For example, if you want to obtain an improved variety of a crop that has higher yield as well as is disease resistant, then you should select two existing crops, one having higher yield and other having more resistance to diseases. When higher yielding plant is crossed with disease resistant plant, then a new variety of plant is produced that contains qualities of both parents.

Thus, the new plant (hybrid) will produce higher yield as well as would be disease resistant.

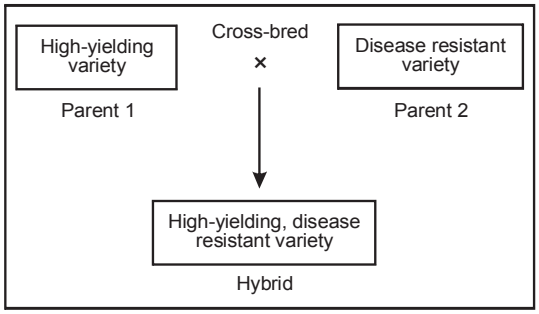
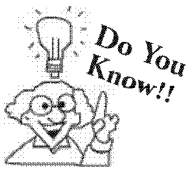


Table : Examples of high-yielding varieties of crops

Crops	High yielding varieties in India
Wheat	Sonalika, Kalyan sona, Sharbati Hira Moti Sonara
Paddy	Jaya, Padma, Pusa 215
Maize	Ganga 101, Rajit, Deccan hybrid



M. S. Swaminathan is known as "Indian Father of Green Revolution" for his leadership and success in introducing and further developing high-yielding varieties of wheat in India.

Knowledge ENHANCER

WHAT IS HYBRIDIZATION?

Hybridization is the process of cross-breeding two different varieties of crop plant each having a desired characteristics to obtain a new crop that has both the desired characteristics. It is used extensively in agriculture, where new forms of disease resistant plants are produced commercially.

THE GREEN REVOLUTION

The average production of most of the crop in our country, India, has doubled during the last 30 years. But the production of wheat crop has tripled during the last 30 years. This great increase in the production of food - grain crops (especially the wheat crop) in India during the last 30 years is called green revolution. This is a sort of revolution taking place in Indian agriculture, leading to enormous food grain production.

Green revolution is a large increase in crop production in developing countries achieved by the use of artificial fertilizers, pesticides, and high-yield crop varieties. The beginnings of the Green Revolution are often attributed to Norman Borlaug, an American scientist. In the 1940s, he began conducting research in Mexico and developed new disease resistance high-yield varieties of wheat. By combining Borlaug's wheat varieties with new mechanized agricultural technologies, Mexico was able to produce more wheat than was needed by its own citizens, leading to its becoming an exporter of wheat by the 1960s. Prior to the use of these varieties, the country was importing almost half of its wheat supply.

Due to the success of the Green Revolution in Mexico, its technologies spread worldwide in the 1950s and 1960s.

NOTE

White revolution

The introduction of growth of milk production and encouraging Indian dairy farmers to keep more animals for increasing production of milk is called white revolution.

Livestock

Livestock are those domesticated or farm animals that are kept for use or profit. The most important livestock of India are cattle, buffaloes which yield milk and help in agriculture. On the basis of their utility animals are categorised as:

– Milk giving animals (Cows, buffaloes, goats)
– Meat and egg giving animals (Sheep, goat, pig, duck)
– Animals utilized as motive power (Buffaloes, horse, donkey, bullock, camel)
– Wool giving animals (Sheep)

Knowledge ENHANCER

Why green revolution is called green?

It is called green because it led to unprecedented greenery of crops everywhere in country. It has made our country self sufficient in food production and even created buffer stocks of food grains for use in times of natural calamities like drought, and flood, when food production is reduced.

FOOD OBTAINED FROM ANIMALS

Like plants, animal also provide us different types of food. The food provided by animals consists of milk, egg and meat. They are rich source of proteins. In fact, animal food provides certain proteins that are not present in plant foods.

Hence, it is important to maintain the population of livestock as they provide various kinds of food to us. It includes various aspects like feeding & breeding and disease control of various animals. This process is known as **animal husbandry**.

Animal husbandry is the science of caring, feeding, breeding and raising the livestock on a large scale. It includes animals like cattle, goat, sheep, poultry and fish.

Objectives of animal husbandry are —

(i) To improve the breeds of domestic animals
(ii) To provide better nutrition and atmosphere to animals so that the yield of their product (like meat, eggs, milk etc) can be increased.

Knowledge ENHANCER

Poultry farming:

The raising of birds such as chickens, turkeys, ducks, and geese, domestically or commercially for the purpose of farming meat or eggs for food is called poultry farming. Poultry are farmed in great numbers with chickens being the most numerous. More than 50 billion chickens are raised annually as a source of food, for both their meat and their eggs.

Bee keeping or Apiculture:

Beekeeping is the maintenance of honey bee colonies, commonly in hives, by humans. A beekeeper (or apiarist) keeps bees in order to collect their honey and other products that the hive produces (like beeswax, propolis, pollen, and royal jelly), to pollinate crops, or to produce bees for sale to other beekeepers. A location where bees are kept is called an apiary or "bee yard".

Fish farming:

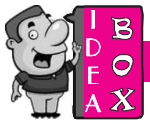
Fish farming is the principal form of aquaculture, while other methods may fall under mariculture. It involves raising fish commercially in tanks or enclosures, usually for food. A facility that releases juvenile fish into the wild for recreational fishing or to supplement a species' natural numbers is generally referred to as a fish hatchery.

Fish species raised by fish farms include salmon, catfish, tilapia, cod and others.

Basically, there are two kinds of aquaculture: extensive aquaculture based on local photosynthetical production and intensive aquaculture, in which the fishes are fed with external food supply.

Cattle farming:

It is the act of raising and breeding cattle for the production of meat or milk. Beef farming is raising beef cattle for slaughter (meat), and dairy farming is raising dairy cows for milk.



idea box

Let us perform an activity to find out various types of animal food and their sources.

Collect the information from your surroundings to complete the given table.

Sl. No.	*Category of Animal*	*Type of food/ material*	*Sources*
1.	*Meat yielding*	*Meat*	*Sheep, Coat, Fish*
2.	*Milk yielding*	*Milk*	*Cow, Buffalo, Goat*
3.	*Egg yielding*	*Egg*	*Hen*
4.	*Honey and wax producing insects*		
5.	*Fibre yielding animals*		
6.	*Silk producing animals*		

SUMMARY

Plants of same kind that grow on a large scale in an area is known as *crop*. E.g. rice, wheat, maize etc.

The production of crops by cultivation of land is called *agriculture.*

In India, crop can be categorised into two types based on seasons – Rabi and Kharif crops.

- **Rabi crops** – Crops grown in rainy season (June – October). Examples – Pea, Mustard, Wheat, Gram etc.
- **Kharif crops** – Crops grown in winter season (November – April). Examples – Paddy, Maize, Groundnut etc.

The basic activities done by farmers in the crop field to raise a particular crop is called *agricultural practices*.

Seven agricultural practices done by the farmer to raise a particular crop are –

1. Preparation of soil
2. Sowing of seeds
3. Adding manure and fertilizer
4. Irrigation
5. Protection from weeds and pests
6. Harvesting, Threshing
7. Storage of food grains

The process of loosening and turning of the soil is called *tilling* or *ploughing*. This is done by plough, hoe and cultivator.

The process of scattering seeds in the ground soil for growing the crop plants is called *sowing*.

The sowing of seed by hand is called broadcasting while the implement used for sowing is a seed drill.

The substances that are added to the soil in the form of nutrients for healthy growth of plants are called manure and fertilizer.

Process of converting dead organic matter into rich humus with the help of earthworm is called *vermicomposting*.

Practice in which leguminous and non-leguminous crops are grown alternately in the same field is called *crop rotation.*

Irrigation is the supply of water to crops at different intervals.

The sources of irrigation are wells, tube well, ponds, lakes, rivers, dams and canals.

The traditional methods of irrigation are moat, dhekli, rahat and chain pump.

The modern methods of irrigation are sprinkler system and drip system.

Process of transferring seedlings from a nursery to the main field, by hand is called *transplantation*.

The unwanted plants that grow along with a cultivated crop are called *weeds*. E.g. Grass, *Xanthium*, wild oat etc.

The process of removing unwanted plants from a crop is called *weeding*.

The cutting of crop after it get matured is called harvesting. It is done manually by sickle.

In large fields, crops are cut by a motorised machine called *harvester*.

In the harvested crop, the grain seeds need to be separated from the chaff. This process is called *threshing*.

Winnowing is the process of separating grain from chaff and hay with the help of wind.

The food grains obtained by harvesting the crops are dried in sunshine before storing.

- Small scale – Jute bags, metallic bins
- Large scale – Silos, granaries

The process of rearing animals to obtain food is known as *animal husbandry*.

1 EXERCISE

Fill in the Blanks :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. The excess water in the field is known as _____.
2. Crops such as _____ requires a constant supply of water.
3. _____ crop is grown during the month of June to October.
4. _____ is the first step to be followed before growing a crop.
5. The process of converting dead organic matter into rich humus with the help of earthworm is known as _____.
6. _____ are good source of nitrogen, phosphorus and potassium but are good for only short term use.
7. Rotation of leguminous crop with wheat or maize is an example of _____.
8. In _____ system of irrigation, water is delivered at or near the roots of the plant drop by drop.
9. Weeds can be removed manually with a _____.
10. The seeds of paddy are first grown in small plots called _____.
11. The substances that are added to the soil in the form of nutrients for the healthy growth of plants are called _____ and _____.
12. _____ is a simple tool which is used for removing weeds and for loosening the soil.
13. _____ is the agricultural practice of breeding and raising livestock.
14. _____ are like artificial rainmakers.
15. Organisms that damage the crop are known as _____

True / False :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. Cotton is a Rabi crop.
2. The agricultural practice, called harvesting comes before weeding.
3. Groundnut enriches the soil with nitrogen.
4. Nitrogenous fertilizer is required for growing nitrogenous crops.
5. In addition to gunny bags, metal bins are also used for storing food grains on large scales.
6. Rotation of crop helps in controlling weeds.
7. Combine is a combination of harvester and thresher.
8. Plough is used for adding manure or fertilizers to the crop.
9. The excessive use of manure causes water pollution.
10. Rabi crops are grown in winter.

Match the Following :

DIRECTIONS : *Question contain statements given in two columns which have to be matched. Statements in column I have to be matched with terms given in column II.*

S.No.	Column-I	Column-II
A.	Plant that is grown in large quantities especially as food or fodder for livestock.	(p) Rabi crops
B.	Crops planted in June and harvested in October	(q) Transplantation
C.	Crops planted in November and harvested in April	(r) Kharif crops
D.	Undesirable plants that grow with the crops	(s) Manure
E.	Process of transferring seedlings from a nursery to the main field	(t) Fertilizers
F.	Process of supplying water to crops at different intervals	(u) Weedicides
G.	Organic substance obtained from decomposition of plant and animal waste	(v) Weeds
H.	Chemical substances that are rich in plant nutrients like nitrogen, phosphorus and potassium	(w) Agriculture
I.	The chemical substance that controls the growth of weeds	(x) Crop
J.	The process of growing plants and rearing animals for food, clothing and other useful products	(y) Irrigation

Very Short Answer Questions :

DIRECTIONS : *Give answer in one word or one sentence.*

1. Name two primary cropping pattern in India.
2. What is crop?
3. Which is the first step in the cultivation of a crop?
4. What is tilling?
5. Name the implement used for ploughing the fields.
6. Which step in the preparation of soil loosens and turns the soil in the fields?
7. What is sowing?
8. Name the implement used in sowing.
9. Name the practice used for cultivating rice.
10. Name the various sources of irrigation in our country.
11. What is meant by term "water lodging" as used in agriculture?
12. Name two substances that are added to fields by farmers to maintain the fertility of soil.
13. What is compost?
14. Name two fertilizers.
15. Which crop is grown between two cereal crops in crop rotation?
16. What is crop rotation?
17. *Xanthium*, grown in a wheat field is known as_____.
18. Give one advantage of drip system of irrigation.
19. Name two implements used for weeding.
20. What are weedicides?
21. Name the chemical substances that are sprayed on crops to protect them from damage.
22. Which agricultural practice is carried out with the help of sickle?
23. Name the process in which grains are separated from chaff and hay with the help of wind.
24. Name the two ways in which farmers store food grains.
25. Name the machine used both for harvesting and threshing.
26. Give two examples of Rabi crops.
27. Give two examples of Kharif crops.
28. What do you mean by nitrogen fixation?
29. Give two example of crop grown from June to October.
30. Name the nitrogen fixing bacteria in root nodules of leguminous plants.

Short Answer Questions :

DIRECTIONS : *Give answer in 2-3 sentences.*

1. How Kharif crop is different from Rabi crop?
2. Give four importance of soil loosening.
3. What are the advantages of levelling?
4. Write down differences between fertilizers and manure?
5. Why is manure better than fertilizer?
6. How are weeds removed manually? When is the best time to remove them?
7. List the steps involved in crop production in sequential order.
8. Differentiate between insecticides, rodenticides and fungicides.
9. Why grains are dried before storage?
10. Which of the following are Kharif crops and which are Rabi crops?
    Soyabean, Barley, Mustard, Peas, Cotton, Groundnut
11. What types of crops are grown :
    (i) During November to April?
    (ii) During June to October ?
12. Name three steps involved in the preparation of soil for sowing the seeds.
13. Which of the following are cultivated by transplantation?
    Paddy, Chillies, Tomatoes, Maize, Wheat
14. State two advantages of the process of transplantation of growing crops?
15. What is the necessity of irrigating the crops?
16. How do weeds affect the growth of crops?
17. What is weeding? State the various methods of weeding.
18. Define the terms –
    (i) Harvesting (ii) Threshing (iii) Winnowing
19. What is a "combine" that is used in agriculture? State its function.
20. What is the advantage of storing food grains in gunny bags?
21. What is done to protect the grains stored in gunny bags in big godowns from damage?
22. Explain the irrigational methods that are used in modern times.
23. How manure is prepared.

Long Answer Questions :

DIRECTIONS : *Answer the following questions in detail.*

1. Explain how soil is affected by the continuous plantation of crops in a field? Why preparation of soil is considered to be an important step in agricultural practices.
2. What are *Rhizobium* bacteria? Why are they useful? What enables leguminous plants to fix nitrogen?
3. What precautions should be taken in sowing the seeds?
4. What are pests? What steps are taken to protect crops from pests? Why should the grains, fruits and vegetables be washed properly before use?

2 EXERCISE

Text-Book Exercise :

1. Select the correct word from the following list and fill in the blanks. float, water, crop, nutrients, preparation
   (a) The same kind of plants grown and cultivated on a large scale at a place is called _____.
   (b) The first step before growing crops is _____ of the soil.
   (c) Damaged seeds would _____ on top of water.
   (d) For growing a crop, sufficient sunlight and _____ and _____ from the soil are essential.

2. Match items in column A with those in column B.

A	B
(i) Kharif crops	(a) Food for cattle
(ii) Rabi crops	(b) Urea and super phosphate
(iii) Chemical fertilisers	(c) Animal excreta, cow dung, urine and plant waste
(iv) Organic manure	(d) Wheat, gram, pea
	(e) Paddy and maize

3. Give two examples of each.
   (a) Kharif crop (b) Rabi crop

4. Write a paragraph in your own words on each of the following.
   (a) Preparation of soil (b) Sowing
   (c) Weeding (d) Threshing

5. Explain how fertilisers are different from manure.

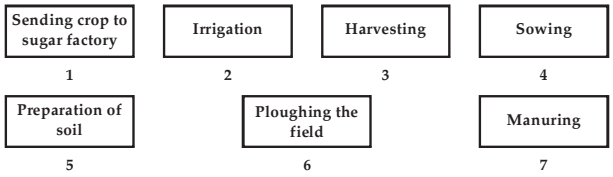
6. What is irrigation? Describe two methods of irrigation which conserve water.

7. If wheat is sown in the kharif season, what would happen? Discuss.

8. Explain how soil gets affected by the continuous plantation of crops in a field.

9. What are weeds? How can we control them?

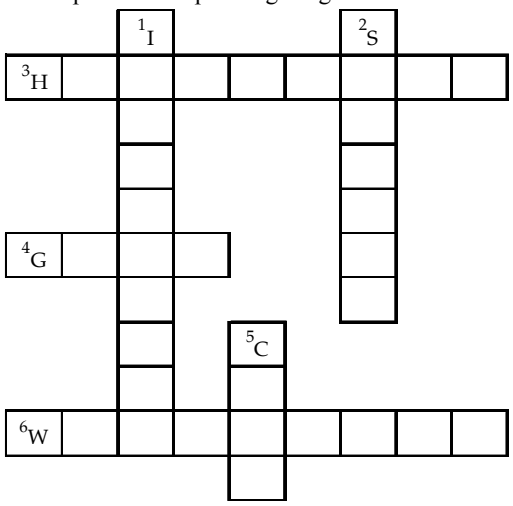
10. Arrange the following boxes in proper order to make a flow chart of sugarcane crop production.



11. Complete the following word puzzle with the help of clues given below.

Down
1. Providing water to the crops.
2. Keeping crop grains for a long time under proper conditions.
5. Certain plants of the same kind grown on a large scale.

Across
3. A machine used for cutting the matured crop.
4. A rabi crop that is also one of the pulses.
6. A process of separating the grain from chaff.



Exemplar Questions :

1. If you are given a dry piece of land for cultivation what will you do before sowing the seeds?

2. During which months do farmers grow mustard in India?

3. Which activity of the farmer can promote growth of earthworms and microbes in the field?

4. What are organic foods?

5. (a) Name the tool used with a tractor for sowing seeds in a field.
   (b) What are the advantages of using this tool?

6 (a) Name the practice followed for large scale rearing of farm animals.
   (b) What facilities are provided to farm animals?

7. Despite favourable climatic conditions, a farmer's crop failed to give good yield. Give the possible reasons for this.

8. As a part of eco-club activity students were asked to raise a kitchen garden in the school premises. They were provided with some materials given in the box. List the other materials you would require. How will you plan the garden? Write the steps.

khurpi, water-can, spade, shovel

Note: You have been asked to use only environment friendly materials.

HOTS Questions :

1. Why do farmers normally use a mixture of manures and fertilizers in the fields?
2. Which method of irrigation will you use if you live in a dry area with shortage of water?
3. Discuss two methods of weeding in which poisonous chemicals are not used.
4. Why does the government maintain a buffer stock of grains?
5. ***Crop rotation is practised by farmers so that they have different products to sell in the market in every season***

   Do you agree? Give reason in support of your answer.
6. Four students proposed four different ways to fulfil the food requirement to a large number of people in our country. Which method according to you can bring about the maximum increase in crop production in our country?

Increase land under cultivation	**Use more manure and fertilizers**
Less wastage in storage	**Use better varieties of crops plants**

7. What happens if the farmer grows Mustard during rainy season instead of winter?
8. "Indian farmers gamble with the monsoon". Illustrate this statement.
9. The recent incidents of farmers' suicides in different states of the country are the result of indebtedness. Do you agree with this?
10. How do pest reduce crop productivity?
11. How does continuous rainfall affect crop production?

3 EXERCISE

Multiple Choice Questions :

DIRECTIONS : *This section contains* **18** *multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct. Choose the correct option.*

1. Person known for his pioneering efforts in promoting the green revolution in India is
(a) Benjamin Franklin (b) Norman Borlang
(c) Robert Brown (d) Albert Einstein

2. Which of the following is not a rabi crop?
(a) Wheat (b) Mustard
(c) Sugarcane (d) Peas

3. Which of the following crops would enrich the soil with nitrogen?
(a) Apple (b) Beans
(c) Paddy (d) Potato

4. The process of turning and loosening of soil is called
(a) tilling(b) harvesting
(c) threshing (d) irrigation

5. Threshing is the process of
(a) separating chaff from the grain
(b) cutting of mature crop
(c) sowing seeds by hands
(d) turning and loosening of soil

6. Which of the following statements is not correct about fertilizer?
(a) It enriches the soil with organic material.
(b) It provides nutrients to the soil immediately in concentrated from.
(c) It increases the crop production several times
(d) It is available in all seasons.

7. Which of the following is a modern method of Irrigation?
(a) Rahat (b) Moat
(c) Chain pump (d) Drip system

8. Which of the following is incorrectly matched?

	Agricultural Steps	Implements Used
(a)	Ploughing	Hoe
(b)	Irrigation	Sprinklers
(c)	Weeding	Trowel
(d)	Harvesting	Harrow

9. The simple tool used for removing weeds and for loosening the soil is called.
(a) plough (b) sickle
(c) harrow (d) trowel

10. The process of putting seeds in the soil for germination is known as
(a) sowing (b) manuring
(c) weeding (d) tilling

11. Ploughing in bigger fields is done by using
(a) hoe (b) cultivator
(c) combine (d) sickle

12. Which of the following statements is not correct about ploughing?
(a) It facilitates deeper penetration of soils.
(b) It maintains fertility of soil.
(c) It helps in proper mixing of organic matter and nutrients evenly.
(d) It helps in enriching the soil with organic matter and nutrients.

13. The process of removing weeds from the cultivated field is known as
(a) weeding (b) weedicide
(c) tilling(d) crop rotation

14. An example of manure is
(a) cow dung
(b) urea
(c) ammonium sulphate
(d) super phosphate

15. The large scale storage of food grains is done in
(a) Gunny bag + Jute bags
(b) Jute bags + Metal bins
(c) Metal bins + Grain silos
(d) Grain silos + gunny bag

16. The last step in crop production is
(a) soil preparation (b) crop harvesting
(c) irrigation (d) sowing

17. An example of fertilizer is
(a) cow dung (b) plant waste
(c) urea (d) urine

18. Which of the following statement is incorrect?
(a) Always use certified seeds to maintain the quality of crop.
(b) Harvest the crop when grains are fully matured.
(c) Use recommended dose of fertilizers.
(d) Irrigate the soil with polluted water.

Assertion & Reason :

DIRECTIONS : *Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect**.

(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

1. **Assertion :** Gram and Barley are Rabi crops.

Reason : They are grown during the months of November to April.

2. **Assertion :** Fertilizers provide quick replenishment of plant nutrients in the soil and restore its fertility.

Reason : They are easily absorbed by the plants.

3. **Assertion :** A fertilizer provides a lot of organic matter like humus to the soil.

Reason : They are very rich in plant nutrients like NPK.

4. **Assertion :** Crop improvement can be done by breeding new varieties of crops having higher yields.

Reason : The main aim of plant breeding is to produce new crops superior to existing ones.

5. **Assertion :** When the crop is changed during crop rotation, the weeds associated with it usually disappear.

Reason : The weeds are very choosy about the crop with which they grow.

6. **Assertion :** Earthworm are called a farmer's friends.

Reason : The burrowing action of earthworms helps to loosen the soil particles.

SOLUTIONS

Brief Explanations of Selected Questions

1 EXERCISE

Fill in the Blanks :

1. Water logging, **2.** Paddy, **3.** Soyabean, **4.** Preparation of soil, **5.** Vermicomposting, **6.** Fertilizers, **7.** Crop rotation, **8.** Drip, **9.** Harrow/Khurpi, **10.** Nurseries, **11.** Manure, fertilizers, **12.** Hoe, **13.** Animal husbandry, **14.** Sprinklers, **15.** Pests.

True / False :

1. False. Cotton is a Kharif crop.
2. False. Harvesting comes after weeding.
3. True
4. False. Nitrogenous fertilizer is not required for growing nitrogenous crops, since leguminous crops can fix the atmospheric nitrogen themselves by using nitrogen fixing bacteria present in their root nodules.
5. False. In addition to gunny bags, silos are also used for storing food grains on large scales.
6. True
7. True
8. True
9. False. The excessive use of fertilizer causes water pollution.
10. True

Match the Following :

A – (x), **B** – (r), **C** – (p), **D** – (v), **E** – (q), **F** – (y), **G** – (s), **H** – (t), **I** – (u), **J** – (w)

Very Short Answer Questions :

1. Kharif and rabi crops.
2. Large scale cultivation of plants of same kind at one place is called crop.
3. Soil preparation
4. Turning and loosening of soil.
5. Plough / Hoe
6. Ploughing
7. Process of placing seed in the ground soil for growth of crop plants.
8. Seed drill
9. Transplantation
10. Wells, canals, rivers, dams, ponds and lakes
11. Water logging refers to saturation of the soil by groundwater sufficient to prevent or hinder agriculture.
12. Manure and fertilizers
13. Compost is a mixture of various decaying organic substances, as dead leaves or manure, used as a fertilizer for growing plants.
14. Urea, Ammonium sulphate
15. Leguminous crops
16. Crop rotation is a practice designed to minimise pests and diseases, reduce chemical use, aid in building and maintaining healthy soil, and manage nutrient requirements-all which will maximise yield.
17. Weeds
18. It avoids random watering of crops.
19. Harrow and Trowel
20. Weedicides are pesticides that are used to kill weeds.
21. 2, 4 - D (2, 4 - Dichlorophenoxy acetic Acid)
22. Harvesting
23. Winnowing
24. Small scale – Jute bags, metallic bins
Large scale – Silos, granaries
25. Combine
26. Pea, mustard
27. Paddy, Maize
28. Nitrogen fixation is the chemical processes by which atmospheric nitrogen is assimilated into organic compounds, especially by certain microorganisms as part of the nitrogen cycle.
29. Groundnut, Maize (Kharif crops)
30. *Rhizobium*

Short Answer Questions :

1.

	Rabi Crop	***Kharif Crop***
(i)	Grown in winter season	Grown in rainy season
(ii)	Seeds are sown in	Seeds are sown in
	October and harvested	June and harvested
	in march.	in September.
(iii)	E.g. pea, mustard,	E.g. paddy, maize,
	wheat, gram etc.	groundnut etc.

2. Importance of soil loosening are –
(i) Roots penetrate deep into the soil and breathe easily, water holding capacity of soil increases.
(ii) Helps in the growth of microbes and earthworm which help in turning the soil and add humus in soil.

(iii) The nutrient rich soil comes up and nutrients are absorbed by plants.

(iv) Proper mixing of manure in the soil.

3. Levelling is a process for ensuring that the depths and discharge variations over the field are relatively uniform and, as a result, that water distributions in the root zone are also uniform. It improves the efficiency of water, labour and energy resources utilization.

4.

	Manure	*Fertilizer*
(i)	Obtained by the	Obtained from
	decomposition of plant	inorganic salt.
	and animal waste	
(ii)	Prepared in fields	Prepared in factories
(iii)	Provides humus to soil	Does not provide humus
(iv)	Rich in plant nutrient	Less rich in plant nutrient

5. Manure is better than fertilizer because it

(i) enhances water holding capacity of soil.

(ii) makes soil porous due to which exchange of gases become easy.

(iii) increases number of friendly microbes.

(iv) improves texture of soil.

6. Weeds are unwanted plants that grow along with crops. They are removed manually by using hand, khurpa, hoe or a rake in small field and in large area they can be removed by ploughing, harrowing etc. The best time to remove weeds is when the soil is damp and moist.

7. Steps involved in crop production are :

(i) Preparation of soil

(ii) Seed selection and sowing

(iii) Manuring

(iv) Irrigation

(v) Weeding

(vi) Protection from animals, birds, pest and disease

(vii) Harvesting, threshing and winnowing

(viii) Storage

8. An insecticide is a substance used to kill insects. They include ovicides and larvicides used against insect eggs and larvae, respectively. Rodenticide is a chemical or other agent used to destroy rats or other rodent pests or prevent them from damaging food, crops, etc. Fungicides are biocidal chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores.

9. Grains are dried before storage to reduce the moisture content of gains because moisture attracts fungus and bacteria resulting in its destruction.

10. Kharip crops : Soyabean, Cotton, Groundnut
Rabi crops : Barley, Mustard, Pea

11. (i) Kharif crops. These crops are sown in the rainy season. Example: paddy, maize, soyabean.

(ii) Rabi crops. These crops are grown in winter season. Example : wheat, mustard, and pea.

12. Ploughing, levelling and manuring.

13. Chillies and tomatoes are cultivated by transplantation. Transplantation usually refers to the practice of taking very young plants that have been started in pots or a nursery and moving them to a large production field.

14. The process of replanting the seedling from the nursery in the main field is called transplantation. Its advantages are :

(i) It enables us to select only healthy seedlings.

(ii) It promotes better penetration of roots in the soil.

15. Irrigation makes agriculture possible in areas previously unsuitable for intensive crop production. Irrigation transports water to crops to increase yield, keep crops cool under excessive heat conditions and prevents freezing.

16. Weed affects crops by competing for water, minerals and sunlight. They also spread pests on the crops and sometimes produce poisonous substances harmful to crops. All these results in low yield of crop production.

17. Removal of unwanted plants that grow along with the crops are called weeding. Weeding can be done by

(i) Manually removing seeds by using hand or trowel or harrow.

(ii) Spraying weedicides which destroy weeds but not the crops.

18. (i) **Harvesting :** Cutting of crop plants after maturation is called harvesting. It is done by cutting the crop plants close to the ground or pulling the crop plants.

(ii) **Threshing :** Separation of grains from chaff is called threshing.

(iii) **Winnowing :** Separation of grains from chaff with the help of wind is called winnowing.

19. Combines are farm machine that aids in the harvesting of grain crops by combining three separate functions into one piece of equipment. The combine harvester performs the processes of reaping, threshing, and cleaning. This allows the crop to be harvested more quickly and efficiently, and enables farmers to harvest larger amounts. Some crops that can be harvested using this machine include wheat, soyabeans, oats and rye.

20. Gunny bags are jute bags which protect the food grains from rodents and other damage while their storage.

21. To protect the grains stored in gunny bags in big godowns from damage, following should be done –

(i) Fumigation with chemicals which repel pest or kill without affecting grain

(ii) Neem leaves are kept along with grains.

(iii) Storage area can be sprayed regularly.

22. The irrigational method that are used in modern times are – Sprinkler system and drip irrigation. Sprinkler system of irrigation is useful for sandy soils and drip irrigation is best technique for watering fruit plants, gardens and trees.

23. Manure is obtained from the decomposition of plant or animal wastes. Plant and animal wastes are dumped in pits at open places and allowed to decompose by microbes. The decomposition product is manure.

Long Answer Questions :

1. Continuous plantation of crops in field makes the soil poorer in important nutrients required for the growth of crops. It leads to decrease in soil fertility and hence the crop yield. Preparation of soil is considered to be an important step in agricultural practices because it helps in loosening the soil. Loosened soil allows growth of microorganism and earthworm thus leading to its enrichment. It also helps the roots to breathe proper.

2. *Rhizobium* bacteria are soil bacteria. It forms a mutually beneficially association with plants. It plays an important role in fixing nitrogen after becoming established inside root nodules of legumes. *Rhizobium* bacteria enable leguminous plants to fix nitrogen. Leguminous plants have bacteria named *Rhizobium* which lives in their roots. It takes in atmospheric nitrogen and then converts it into a soluble form which the plant can absorb. These bacteria cannot make their own food so they provide nitrogen to the plant and in return they get food and shelter.

3. Precautions taken in sowing the seeds are :

(i) Seed should be sown at right spacing to get sufficient amount of sunlight, water and nutrients.

(ii) Seed should be planted at proper depth in the soil. If they are planted deep in the soil then they cannot respire properly and if planted on surface then can be eaten by birds.

(iii) Seed should be clean, healthy and free from disease.

(iv) Seeds require water for germination. The soil therefore should have water in it.

4. A pest is any organism that spreads disease, causes destruction or is otherwise a nuisance. Some examples of pests are mosquitoes, rodents, and weeds. Crops can be protected by using pesticides. Grains, fruits and vegetables should be washed properly before using to remove pesticides coated on them. Because pesticides are harmful poisonous chemicals which affect our health.

2 EXERCISE

Text - Book Exercise :

1. (a) The same kind of plants grown and cultivated on a large scale at a place is called _ crop _.

(b) The first step before growing crops is _ preparation__ of the soil.

(c) Damaged seeds would __float__ on top of water.

(d) For growing a crop, sufficient sunlight and _ water __ and ___ nutrients_ from the soil are essential.

2.

	A		**B**
(i)	Kharif crops	(e)	Paddy and maize
(ii)	Rabi crops	(d)	Wheat, gram, pea
(iii)	Chemical fertilisers	(b)	Urea and super phosphate
(iv)	Organic manure	(c)	Animal excreta, cow dung, urine and plant waste

3. (a) Kharif crop → Paddy, maize

(b) Rabi crop → Wheat, gram

4. (a) Preparation of soil:

It is the first **method** to be followed before growing a crop. This method is used for loosening the soil so that the root can penetrate deep into it. The loosening of the soil helps in the growth of several soil microbes, earthworms etc., which enrich the soil with humus and other essential nutrients. Plants require nutrients for their proper growth and functioning. The process of loosening is called ploughing. This brings the nutrient-rich soil to the top, which helps the plants to utilize the nutrients for their growth.

(b) Sowing:

Sowing is an important step in crop production. In this process the seed is placed in or on the soil for future growth. The seeds that are selected should be of good quality. This improves the net yield of the crop. Sowing is usually done with the help a traditional tool or a seed drill. The traditional tool is like a funnel and was used earlier. Nowadays, seed drills that make the use of tractors are used for sowing. This tool disperses seeds uniformly and sows seeds at proper depth. This method saves time and also protects the seeds from birds.

(c) Weeding:

Undesirable plants that grow along with the crop are known as weeds. The process of removing these weeds is called weeding. *Xanthium*, *Parthenium*, etc. are some common weeds. Weeds compete with the crop for nutrients, light, and space. As a result, crop plants get lesser nutrients, light, and space for their development which reduces their productivity. This is why, various weeding **methods** are employed.

Some important weeding methods are:

(i) Weeds can be controlled by using weedicides. It is a chemical, which is sprayed in the fields to kill all the weeds without causing any harm to the crop.

(ii) Tilling before sowing of crops also helps in removing weeds. Tilling uproots the weeds. The best time for removal of weeds is before flowering.

(iii) The manual method of weeding is with the help of a khurpi. It involves regular uprooting of weeds close to the ground.

(d) Threshing:
Threshing involves the process of separating grains or seeds from chaff. It is done after harvesting. It is done with the help of a machine known as 'Combine'. This machine is a combined harvester and thresher. It harvests plants as well as cleans grains.

5. Differences between fertilisers and manure:

Fertiliser	Manure
Fertilisers are commercially available plant nutrients.	Manure is a natural substance. It is prepared by the decomposition of animal excreta and plant wastes.
They can be organic or inorganic in nature.	Manure is known to have a large quantity of organic materials and very little amount of plant nutrients.
They ensure healthy growth and development of plants by providing them with nitrogen, phosphorus, potassium, etc.	They help in enriching the soil with organic matter and nutrients.
The addition of fertilisers to the soil requires special guidelines such as dose time, post addition precautions, etc., to be followed.	The addition of manure does not require any special guidelines.
A fertiliser does not provide any humus to the soil.	Manure provides humus to the soil and increases soil fertility.
Its excessive use causes water pollution. It cannot replenish organic matter of soil.	It protects the environment and helps in recycling farm waste.

6. Irrigation is the method of supplying water to crops at different intervals. The time and frequency of irrigation varies according to different seasons, crops, and soil types. There are various sources of irrigation such as wells, canals, rivers, dams, ponds, and lakes. Two important methods of irrigation which are helpful in conserving water are:

(a) Sprinkler system:
In this method, water is supplied through pipes to one or more central locations within the field. When water is allowed to flow under high pressure with the help of a pump, it gets sprinkled on the crops. This system is more useful on uneven land, having fewer water supplies.

(b) Drip system:
In this method, water is delivered at or near the roots of plants, drop by drop. This is the most efficient method of irrigation as there is no wastage of water at all. This method is important in areas having water scarcity.

7. If wheat is sown in the kharif season (from June to October), then the whole crop might get destroyed because of many factors such as lack of optimum temperature, in appropriate day length, availability of pests, excess of rain etc. Therefore, wheat crop should not be sown during this season.

8. Continuous plantation of crops in a field makes the soil deficient in certain nutrients such as nitrogen, phosphorus, potassium, etc. This is because plants require nutrients for their proper growth and functioning. When a farmer continues to grow crops one after the other, all the nutrients available in the soil reduces and the crop yield decreases automatically.

9. Undesirable plants that grow along with crop plants are known as weeds. *Xanthium*, *Parthenium*, etc. are some common weeds. Weeds compete with the main crop for nutrients, light, and space. As a result, crop plants get lesser nutrients, light, and space for their development. This in turn, reduces their productivity. Thus, various weeding methods are employed.

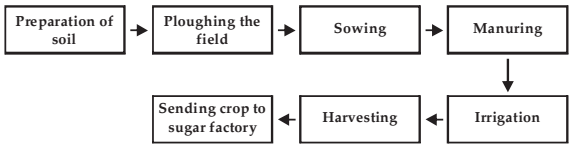
Some important weeding methods are:

(i) Weeds can be controlled using weedicides. These are chemicals, which can be sprayed in the fields to kill all available weeds. Weedicides are not harmful to the main crops.

(ii) Tilling before sowing of crops also helps in removing weeds. Tilling uproots the weeds. The best time for the removal of weeds is before flowering.

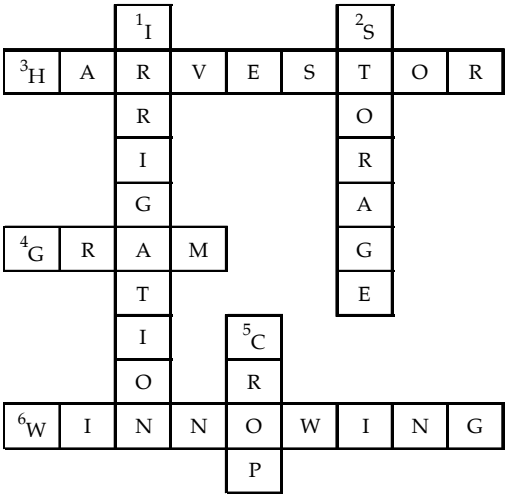
(iii) The manual method weeding is with the help of a khurpi. It involves regular uprooting or cutting of weeds close to the ground.

10. Flow chart of sugarcane crop production:



11. Down
1. Irrigation
2. Storage
5. Crop

Across
3. Harvestor
4. Gram
6. Winnowing



Exemplar Questions :

1. The field will be watered, tilled and ploughed before sowing seeds.
2. October to March.
3. Loosening the soil/maintaining high moisture levels in soil.
4. Crops cultivated without using any chemicals like fertilisers, pesticides, weedicides etc. are called organic foods.
5. (a) Seed drill.
   (b) The advantages are,
   (i) seeds are sown at a uniform distance and depth to avoid over crowding.
   (ii) after sowing, seeds are covered by soil which prevent them from being eaten by birds.
   (iii) It saves time and labour.
6. (a) Animal husbandry.
   (b) Animals are provided with proper food, shelter and care.
7. (i) He did not use good quality seeds.
   (ii) His field was not well irrigated.
   (iii) Manures/fertilisers were not properly applied.
   (iv) Weeds were not removed. More can be added to the list.
8. The following items are required – seeds and seedlings of vegetable plants from nursery, kitchen waste, water.
   Step for raising the garden:
   1. Kitchen waste will be collected and composted in a pit.
   2. A patch of land will be identified for the garden.
   3. Soil will be dug up and levelled with the help of a spade.
   4. Sowing of seeds / transplanting of seedlings.
   5. Select seeds/seedings as per the season. Water the plants regularly with a water-can.
   6. Compost will be applied.
   7. Weeds will be removed periodically with the help of khurpi.

HOTS Questions :

1. Farmer use a mixture of manures and fertilizers in the field so that the nutrients which cannot be fulfilled by the manures can be fulfilled by the plants and the nutrients which are not in the fertilizers can be fulfilled by the manures, *e.g.* - NPK [nitrogen, phosphate and potassium] fulfil the nutrients which are not present in the manures.
2. Sprinkler system of irrigation. This system is used on the uneven land where less water is available. Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground.
3. Crop rotation and proper ploughing before sowing seeds helps in removing weeds. In these methods poisononous chemicals are not used.
4. An extra stock called buffer stock is maintained so that grains are available in plenty even if there is a short fall in production in a particular year, for example due to monsoon failure.
5. No, this is not true. Crop rotation helps replenishment of the soil with nitrogen.
6. To fulfil the food requirement of increasing population in our country we need to constantly increase the food grain production. This can be done by increasing the land under cultivation. But we cannot indefinitely go on increasing farmland, as this leads to environmental problems.
   Hence, improvement in the methods of agricultural practices is the most suitable alternative to increase crop produce. Better irrigation methods, proper use of manure and fertilizers etc will help improving the crop produce.
   Also, by providing better storage methods, we can reduce wastage of food grain. However, recently, an increase in crop produce has come about from using better varieties of crops that have higher yield and more resistance to diseases.
   Hence, these days, use of better varieties of crop plants has brought about maximum increase in crop production in our country.
7. Mustard is a Rabi crop which requires cold and dry weather. Therefore, in rainy season it will not grow well and gets destroyed in excess water.
8. (i) Uneven distribution of rainfall-spatial and temporal
   (ii) Uncertainty of monsoon.
   (iii) Lack of irrigation facilities
   (iv) Frequent flood and drought is a common phenomenon associated with the monsoon.
9. Yes, the reasons are as follows :
   (1) Less income or savings.
   (2) Crop failure
   (3) Difficult procedure of financial institution which has pushed them to borrow from private money lenders at high rate of interest.
   (4) Inadequate support price of procurement of crops
   (5) Low returns from agriculture.
   (6) Lack of implementation of land reforms.
10. Pests are organisms that attack and damage crops. They can limit crop productivity.
11. Continuous rainfall will make cultivation difficult and reduces agricultural output. All plants need at least some water to survive; therefore rain (being the most effective means of watering) is important to agriculture. While a regular rain pattern is usually vital to healthy plants, too much or too little rainfall can be harmful, even devastating to crops. Drought can kill crops and increase erosion, while overly wet weather can cause harmful fungus growth. Plants need

varying amounts of rainfall to survive. For example, certain cacti require small amounts of water, while tropical plants may need up to hundreds of inches of rain per year to survive.

3 EXERCISE

Multiple Choice Questions :

1. (b) Dr. Norman Borlang, an American agricultural scientist was the first to promote the green revolution in India.

2. (c) Sugarcane is not a Rabi crop. It is a Kharif crop. Kharif crops are grown in rainy season.

3. (b) Beans is a leguminous crop that enriches the soil with nitrogen. Leguminous crops fix the atmospheric nitrogen themselves by using nitrogen fixing bacteria present in their root nodules.

4. (a) The process of turning and loosening of soil is called ploughing or filling. Harvesting is the process of cutting the crop and gathering them to transport it to the market. Threshing is the process of separating the chaff from the grain. Irrigation is the process of watering the plants in a field.

5. (a) Threshing is the process of separating the grain seeds from pods or chaff. The process of cutting of mature crop is known as harvesting. The process of sowing seeds by hands is known as broadcasting while ploughing is the process of turning and loosening of soil.

6. (a) Manure enriches the soil with organic material (humus). A fertilizer does not provide any humus to soil.

7. (d) Drip system of irrigation is a modern method of irrigation. In this method water is delivered at or near the roots of the plant drop by drop. Moat, Rahat and chain pump are traditional methods of irrigation, they are cheaper but less efficient.

8. (d) Harrow is used for removing unwanted plants (weeds) from the crops. The implements used for harvesting are sickle and harvesting machine.

9. (a) Plough is an implement made of wood. It is drawn over soil to turn it over and cut furrows in preparation for the planting of seeds. Sickle is an implement for cutting grain, grass, etc., It consists of a curved, hook like blade mounted in a short handle. Harrow is a cultivating implement set with spikes, spring teeth, or disks and used primarily for pulverizing and smoothing the soil. Trowel is a small tool with a curved blade that is used by gardeners for digging holes.

10. (a) Manuring is addition of manure to the soils to improve its fertility. Weeding is the removal of undesirable, unattractive, or troublesome plant especially one growing where it is not wanted. Tilling is to prepare (land) for the raising of crops, as by plowing and harrowing.

11. (b) Ploughing in bigger field is done by cultivator. Cultivator is a mechanical implement for breaking up the ground and uprooting weeds. Hoe is a long-handled gardening tool with a thin metal blade, used mainly for weeding. Sickle is a hand-held agricultural tool with a variously curved blade. It is used for harvesting grain crops or cutting succulent forage chiefly for feeding livestock. Combine is a farm machine used for both threshing and harvesting.

12. (d) Manuring helps in enriching the soil with organic matter and nutrients.

13. (a) Weedicide is a chemical or organic substance which is used to remove unwanted plants mainly like weeds which effect the healthy growth of the plant. Tilling is to prepare (land) for the raising of crops, as by plowing and harrowing. Crop rotation is the practice of growing different crops in succession on the same land chiefly to preserve the productive capacity of the soil.

14. (a) Cow dung is an example of manure. Manure is organic matter used as organic fertilizer in agriculture. It contributes to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. Urea, ammonium phosphate and superphosphate are fertilizers.

15. (d) The large scale storage of food grains is done in grain silos and gunny bags.

16. (b) Crop harvesting is the last step in the production of crop. Harvesting is the cutting and gathering the mature crop.

17. (c) Urea is an example of fertilizer. Fertilizer is a manmade mineral salt which are added to the soil to provide nutrients like nitrogen, phosphorous and potassium.

18. (d) Appropriate supply of water to the crop is called irrigation. Soil cannot be irrigated with polluted water.

Assertion & Reason :

1. (a) Rabi crops refer to agricultural crops sown in winter and harvested in the spring. It is the spring harvest (also known as the "winter crop") in Indian subcontinent. The Rabi crops are grown between the months mid-November to April. The water that has percolated in the ground during the rains is main source of water for these crops. Examples of Rabi crop are wheat, gram, pea, mustard, linseed, barley.

2. (a) Fertilizers are any of a large number of natural and synthetic materials, containing the chemical elements that improve growth and productiveness of plants. Fertilizers enhance the natural fertility of the soil or replace the chemical elements taken from the soil by previous crops. Modern chemical fertilizers include one or more of the three elements most important in plant nutrition: nitrogen, phosphorus, and potassium.

3. (d) Refer answer 2

4. (b) Crop improvement refers to the genetic alteration of plants to satisfy human needs. It proposes to obtain higher yield, better quality, resistance to disease and shorter duration which are suitable to a particular environmental condition.

5. (a) Weed species are typically associated with crops, and crop rotations determine their specific weed population over time. Crop rotation is the system of growing a sequence of different crops on the same ground so as to maintain or increase its fertility, to avoid depleting the soil and to control weeds, diseases, and pests.

6. (a) Earthworms are called farmer's friend because they play an important role in breaking down dead organic matter in a process known as decomposition. Decomposition releases nutrients locked up in dead plants and animals and makes them available for use by living plants. Earthworms are also responsible for mixing soil layers and incorporating organic matter into the soil. Charles Darwin referred to earthworms as 'nature's ploughs' because of this mixing of soil and organic matter. This mixing improves the fertility of the soil by allowing the organic matter to be dispersed through the soil and the nutrients held in it to become available to bacteria, fungi and plants.